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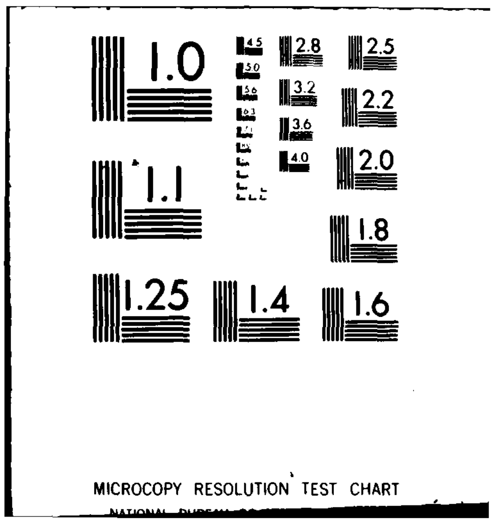
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THE COMPUTER ASSISTED AIR TASKING ORDER PREPARATION SYSTEM

BY

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603RD TACC SQ (314TH AIR DIVISION)
COMBAT PLANS DIVISION, OSAN, KOREA

AN ENHANCEMENT TO THE COMPUTER
ASSISTED FORCE MANAGEMENT SYSTEM (CAFMS)
AND CONSTANT WATCH PROGRAM

29 JULY 1981

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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SUBJECT: Review and Clearance for Public Release of Technical Paper

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(1) The Computer Assisted Air Tasking Order Preparation System, Major Joseph P. Sowa, Test Manager, TR-1 System Program Office

(2) N/A

(3) 1981 Airpower Symposium, Air War College, Maxwell AFB, AL 36112

(4) 1-3 Mar 82

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JOSEPH P. SOWA
Major, USAF
ASD/RWT

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ABSTRACT

Theater commanders world wide have not been able to influence the air battle in a timely manner. The main culprit causing this state of affairs has been the manual procedures used to translate the commander's force apportionment and allocation decision into a usable frag order. We cannot and must not allow this situation to continue.

Currently, commanders make force apportionment and allocation decisions more than 30 hours prior to the time period they are effective. This is necessary due to the slowness of the present manual ATO preparation and dissemination process. Twenty hours are required to prepare the most complex ATO. An additional 10 hours is required for communications and aircraft preparation lead time. Present programs to improve this situation address improvements in communications but do not attack the primary problem: manual production of the ATO.

This paper proposes expansion of current programs to extend computer assistance benefits to preparation of ATO. The current 20 hour ATO generation time can be reduced to approximately 6 hours or less. Two benefits are derived:

1. Significant decrease in the commander's decision lead time for apportionment and allocation.

2. Opportunity to inject near real time intelligence and fleeting target exploitation into air battle strategy and objectives as expressed in the ATO.

The paper describes an existing computer assisted Air Tasking Order (ATO) generation system including a computerized program which promises to make

substantive savings in time, maintain, if not increase accuracy of the frag order, and most importantly, provide our commanders the responsiveness they need to successfully conduct an air campaign. It attacks the primary problem, i.e., the manual production of the ATO. By incorporating software programs in the preparation of the ATO we realize all the benefits that computerization can provide and actually revolutionize the commander's capability to manage his tactical forces in a timely manner. Shortening of the decision-to-action cycle presents the TACAIR commander with unprecedented opportunity to inject strategy, tactics and objectives into the frag order on short notice. Without it, a further erosion of command will occur, with personnel other than those in operations and command functions making forces employment decisions.

The computer assisted ATO preparation capability described herein not only improves the speed and responsiveness of the ATO but revolutionizes the commander's capability for influencing management of his tactical air forces. This capability will become absolutely required in responding to the challenges facing TACAIR employment as the new surveillance and target acquisition technology comes on board in the mid-80's.

BIOGRAPHICAL SKETCH

Major Joseph P. Sowa served as Chief, Fighter Frag Branch, Combat Plans Division, in the Tactical Air Control Center, Osan, Korea, August 1980 - August 1981. Prior to that he served as Flight Test Manager and Chairman of the Test Planning Working Groups for both B-1 and B-52 modernization programs. His previous assignments include Instructor Pilot, ATC; Directorate of Communications-Electronics, HQ Fifth Air Force; Directorate of Materiel Management, San Antonio Air Logistics Center; and Vietnam where he flew 980 hours as a Forward Air Controller. A 1962 graduate of Loyola University, Los Angeles, CA, in Mechanical Engineering, Major Sowa holds masters degrees in both Mechanical Engineering and Business Administration. He is also a graduate of the Defense Systems Management College. He is currently assigned to the TR-1 System Program Office, Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

ACKNOWLEDGEMENTS

My deepest thanks to Colonel Chuck Link, Commander, 603rd TACC Squadron and 314th Air Division Director of Combat Operations. His active cooperation provided the necessary access to the current CAFMS development. His sage advice and counsel, particularly on integration of this new capability to meet the commander's needs, were an invaluable addition to this paper.

To Major Pete Crossman, Chief, WWMCCS Branch, Combat Plans, 603rd TACC Squadron, I owe a deep debt of gratitude. Seldom, when dealing in conceptual writing does one also have the chance to see the birth. Pete, starting from my original draft scribblings, produced demonstration software on WWMCCS Frag II that contributed substantially to development of the final product.

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CHAPTER I

INTRODUCTION

Few would argue with the introduction of the ground attack aircraft having changed dramatically the character of modern warfare. Those early military aviation pioneers saw clearly the unique qualities that airpower brought to the battlefield: mobility, flexibility and mass. Ultimate mobility, greater flexibility and mass firepower superior to any other weapon. One four ship flight of F-4s can deliver 50,000 lbs. of high explosive bombs over a period of less than one minute on any target within many thousand square miles of enemy territory. The kinds of munitions available offers a wide range of strategies from outright destruction (bombs) to area denial (mines), pinpoint accuracy (retarded munitions) to wide area effects (CBU). Modern technology has brought night all weather capability. Future developments promise even greater capability to see and attack the enemy under conditions impossible to conceptualize only a few years ago.

With all these advances, the capability of airpower to react to fleeting lucrative targets, exploit enemy weakness and friendly force successes, rapid changes in strategy (ours and that of the enemy), has comparatively not yet emerged from the stone age. Our capability is only as good as our system for ordering the desired changes to exploit opportunity, neutralize, surprise or seize the initiative. The primary means for this ordering is called the Air Tasking Order (ATO) or the "Frag Order".[1] When the Frag Order becomes as flexible as the air weapon it commands, we will have achieved the proper balance. The current manual Frag Generation System and its near term planned improvements fall far short of this goal.

Experience during simulated combat exercises (Team Spirit and Focus Lens), operational readiness exercises/inspections and numerous other exercises of the ATO (Frag) cycle in the Combat Plans Division of the 603rd TACC has proven the

need for shortening the Frag Order Generation Cycle. Figure 1 depicts the generation cycle for a typical Frag Order for the Offensive Air Support (OAS) and Offensive Counterair (OCA)/Interdiction Strike (INTSTK) portion of the air battle. The time consuming, intricate planning which goes into forming these Frags takes approximately 20 hours, culminating in transmission 10 hours prior to its effectivity to allow time for receipt at users locations, posting, and generation of the necessary aircraft. The starting point for generation of the Frag is the Joint/Combined Commander's (CINC) and the Air Component Commander's (CACC) decisions dividing the air assets among the various tasks in accordance with campaign strategy and results of the battle to date. Currently, these decisions must be made more than a day before they are implemented in order to allow time for generation and dissemination of the Frag. On a fluid battlefield, often the commander desires to alter his apportionment/allocation to exploit breakthroughs and enemy weakness or other current events. Limitations of the current manual Frag Generation System make it unable to react readily to short notice requirements changes. Late publication of the Frag is often the result, with deteriorated efficiency of the Tactical Air Control System (TACS) a result. Automation of the Frag cycle offers promise of rapid response to late changes in the battle strategy while still publishing a timely Frag Order.

Current Efforts Toward Improvement

The current effort by HQ TAC and the Tactical Air Forces Integration Group (TAFIG) to improve the response capability of the TACS through use of computers is called the Computer Assisted Force Management System (CAFMS). The present state of CAFMS design provides a system for rapid dissemination of the Frag. CAFMS virtually replaces the World Wide Military Command and Control System (WWMCCS) and the Communications Center as the primary mode of transmitting the Frag. It does not, however, provide the computer tools to actually generate the Frag Order. That task remains a manual, hand-drawn document until finalized and entered into CAFMS as is done with WWMCCS now.

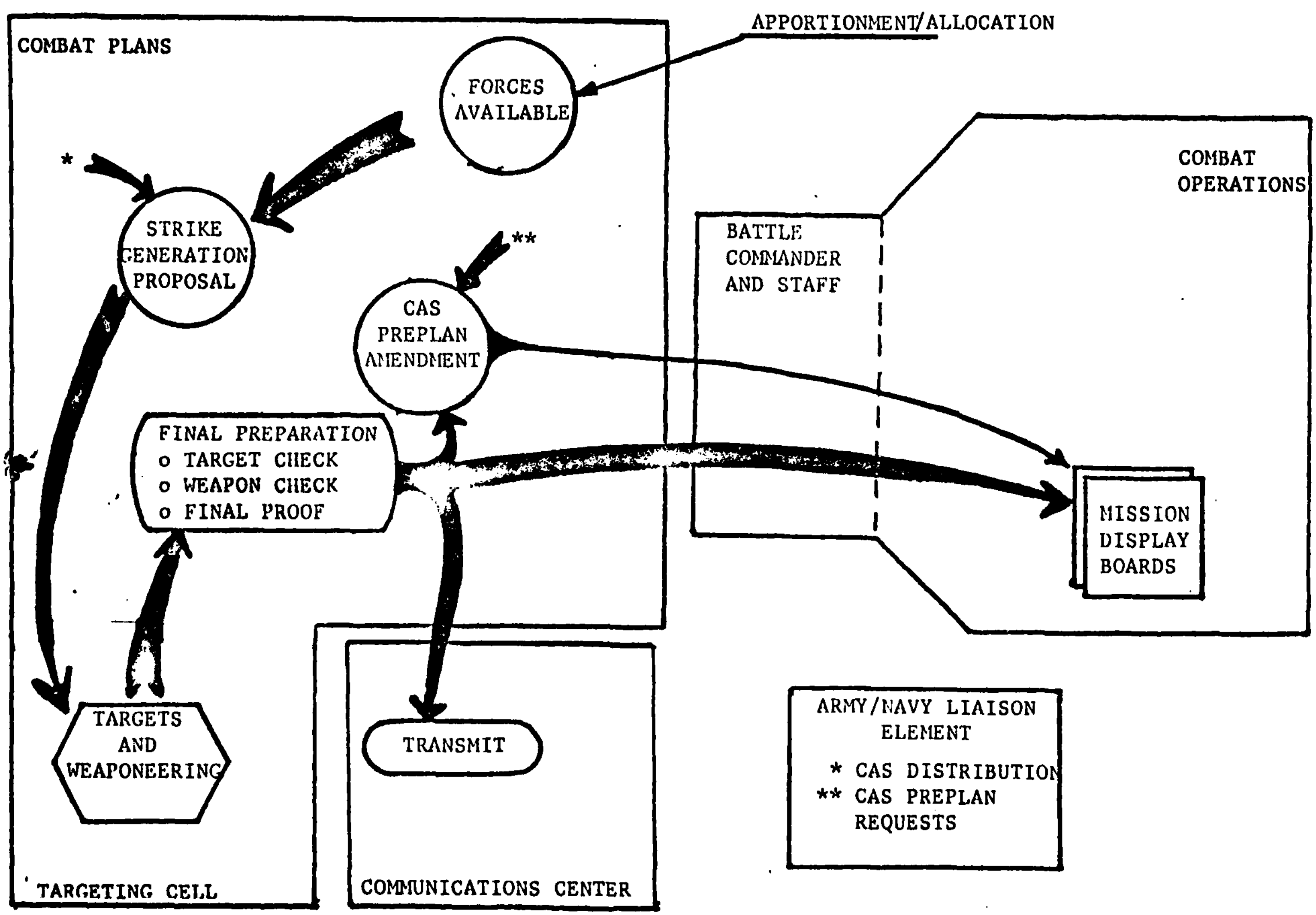

FIGURE 1. TYPICAL MANUAL ATO GENERATION CYCLE (GENERATION TIME 20 HOURS)

Purpose

This paper presents proposals for computer applications software in the form of a functional description of how a computer assisted Frag Order Generation System would perform. Computer generation of the Frag is an attainable goal. The steps, or stages, of the Frag Generation Cycle are definable. Each has a set of numerical computations or relationships and an associated information data bank provided from within the Frag Shop or other functional offices within the Tactical Air Control Center (TACC). Using a combination of computer calculations and visual presentations with a human operator link or programmed search module, to the information data banks, the computer can be harnessed to assist in preparation of Frag Orders. Development of this computer assisted Frag Generation as a part of PACAF's Constant Watch Phase III Program (or earlier on existing Frag II software), or as an integrated part of CAFMS promises shortening the Frag Generation Cycle from 20 hours to approximately one-third of that time. Shortening the entire Frag Generation/Dissemination Cycle to approximately 6 hours provides the air battle commander with the opportunity to express today's strategy and objectives for tomorrow's war through the Frag Order. A quantum advance in the state of the art.

Approach

The following discussion is geared to production of the OAS and OCA/INT[2] Frag Orders since these are the most intricate, complex and time consuming Frags to produce. The numbers used in this example are ficticious but close enough to reality to be useful. Because the subject Frags deal with our friendly forces attacks on enemy territory, they must orchestrate the efforts of diverse mission groups in our high technology air combat force. This must be done while keeping the strike set within a small time window and limited strike area to preserve mass and mutual supportability. Strategy may require constant pressure on the enemy; therefore, a succession of strike sets must be produced on an around the clock basis. Alternatively, the system must be

able to adjust to the single, large force (or "gorilla") strike strategy. Offensive forces, because they strike into enemy territory, are formed into strike packages or sets. Each package or set has a mix of forces (strikers, CAP, air defense suppression) for mutual support and protection. The orchestration of forces in the right amounts and within the capacity of our force generation capability while meeting battle objectives is what the Fragger's task is all about. In forming each set, the man-machine system must accommodate limiting factors such as: the capability of friendly forces to generate aircraft and crews, weather patterns, target priorities, consideration of enemy strength, exploitation of his weakness; among others. A Fragger, assisted by the computer, will be freed of time consuming calculations and have the necessary data and displays at hand to apply full effort to solving complex tactical problems, implementing nuances or radical changes of strategy and still produce the Frag in a fraction of the current time required. The descriptions given in Section Three assume operation of a full up applications software set.

Operations Concept

Figure 2 depicts the functional offices in the TACC which contribute to generation of the Frag Order. Each data reporting activity reports the status of its responsible area at regular intervals or as significant changes occur. These reports update displays which are called up by the Fragger during various steps of Frag Generation. Figure 3 depicts the series of steps and data inputs which comprise the computer assisted Frag Generation Cycle. At appropriate times the Fragger enters numerical data or program instructions which result in formated displays to accommodate the next step. All along the way in appropriate places, the Fragger picks data off supporting information displays or instructs the machine to execute a search and select program to complete the Frag format display. During formation of the Strike Generation Matrix and again just before transmittal to users, the air battle commander is consulted/briefed on Frag strategy/accomplishment. During other steps, consultation with collateral offices or the battle commander may be

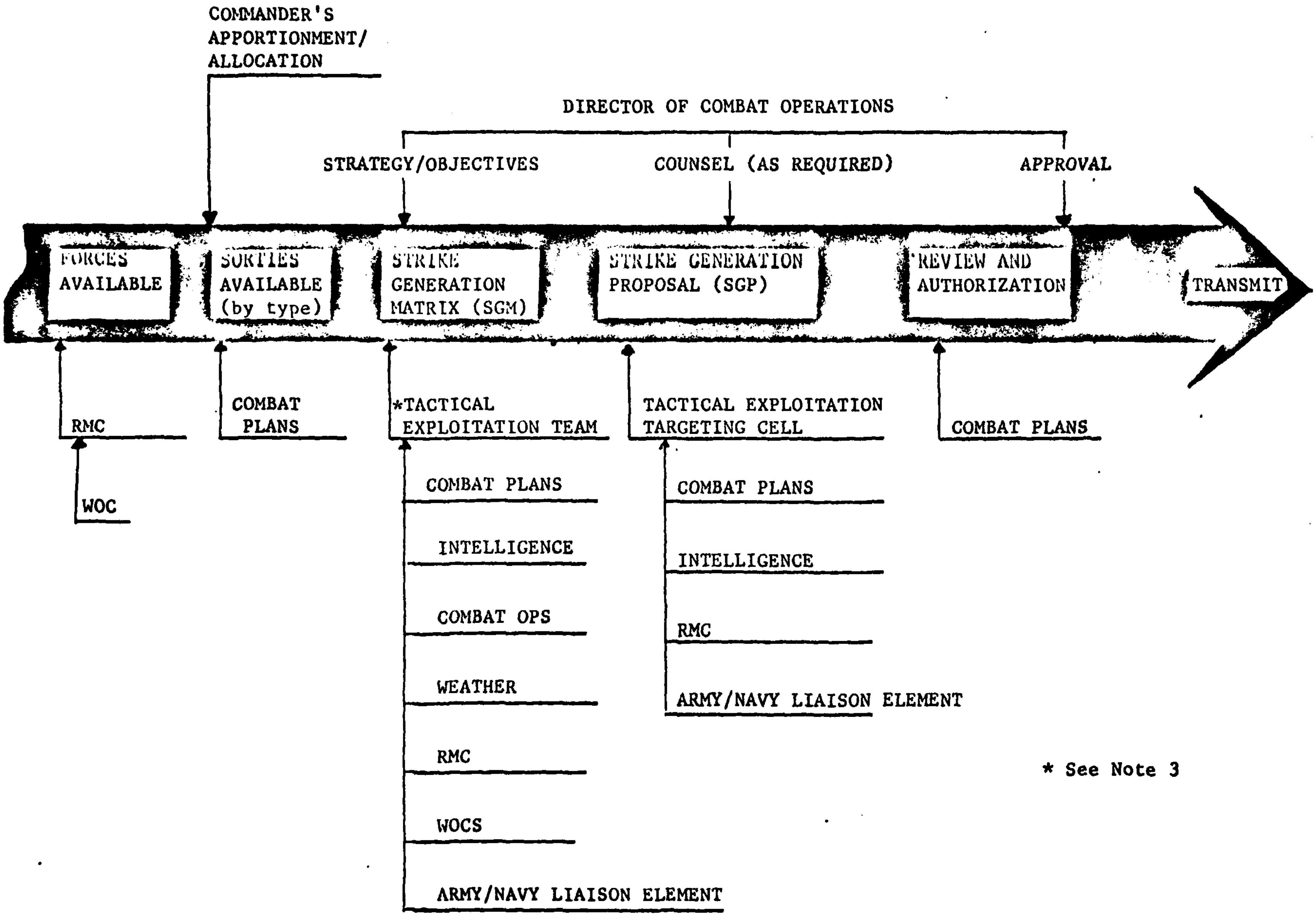

FIGURE 2. FUNCTIONAL OFFICES CONTRIBUTING TO ATO GENERATION

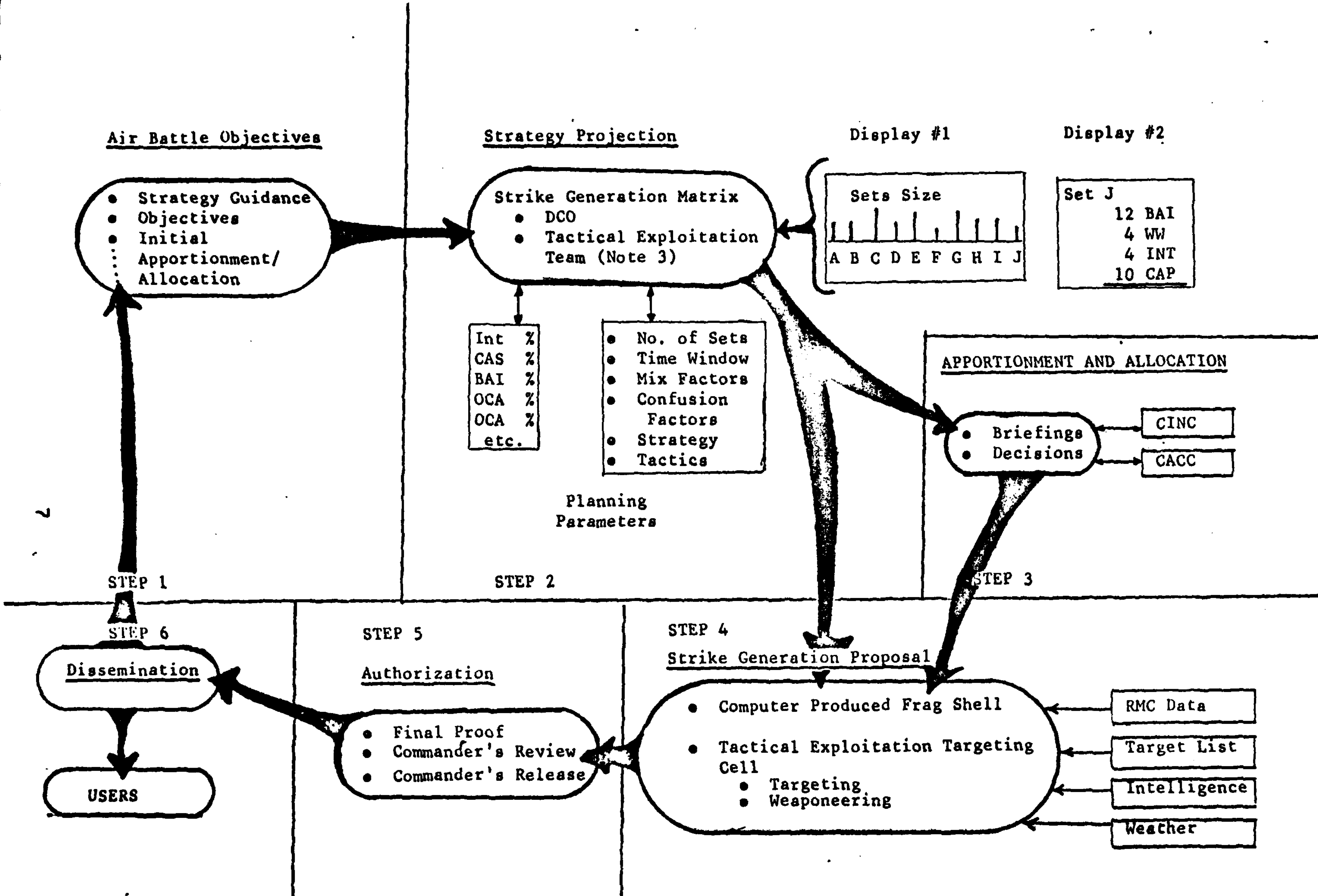

Figure 3. Computer Assisted ATO Generation Cycle
(Generation Time 6 Hours)

accomplished by CCTV or joint viewing of individual video displays and phone communications. Final review of the finished product may be accomplished by conference or conference phone and common visual display. Ideally the air battle commander will be briefed/consulted in a conference room using a large pictorial graphics display of the air/ground situation overlayed with the Frag pictorial. Discussions between the air battle commander and action officers of his Tactical Exploitation Team[3] at an initial meeting will form the Strike Generation Matrix and targeting strategy. A final meeting will capsule the resultant Frag and request authorization for release. Note the radical differences between Figures 1 and 3. Computer assistance has provided the means to get the commander and the Director of Combat Operations actively into the Frag Generation loop. It has also provided a means to use detailed strategy and objectives planning to form the apportionment/allocation decision briefings, rather than the other way around.

CHAPTER II

DATA SOURCES

To provide parameter inputs for execution of algorythms necessary to Frag Generation, the following activities will be sources of data:

1. The Joint or Combined Force Commander gives direction on Air Forces apportionment.

2. Air Component Commander (CACC) determines allocation of Air Forces and provides guidance on strategy in employment of the air arm to achieve the CINC's objectives.

3. The Director of Combat Operations provides specific guidance and articulates objectives to implement the commander's guidance.

4. Tactical Exploitation Team. The commander, with assistance from this group of experts from the operations, plans and intelligence communities, devises the coherent attack and targeting strategy to neutralize the enemy threat, achieve tactical advantage and seize the initiative.

5. WOCS. Wing Operational Center (WOCS) report number of aircraft operationally ready and aircraft/aircrews available for operations during the next Frag period. Reports include sortie generation capability in normal and specialty weapons such as "Pave Tack" and "Maverick". This data is gathered and summarized as required by RMC.

6. The Resource Management Center (RMC) provides current status on stocks of available munitions and POL at each base, status of augmentation forces, delivery/arrival schedules, as well as current O/R status for each unit's aircraft/aircrews.

7. Army/Navy Liaison Office provides distribution guidance for CAS sorties among the surface maneuver units. Requests for preplanned air support to surface units are gathered here and forwarded to combat plans.

8. Intelligence Division provides target intelligence, target lists and additional expertise on targeting and weaponeering.

9. Combat Operations provides feedback on success or failure of the Frag Order both to the Director of Combat Operations and Combat Plans Division to enable improvements in Frag effectiveness, and provision of data base information for revised apportionment recommendations.

10. The Weather Shop provides predictions of battle area and interdiction area target weather.

11. Combat Plans provides the expertise in employment of tactical weapons systems, targeting and munitions which enable the wedding of all the above data into an orchestrated air attack described by the OAS and OCA/INT Frag Orders.

CHAPTER III

PROCEDURES

The distinct steps in computer assisted generation of the daily Frag Order are depicted in Figure 3. The following are detailed procedures to be carried out by the Frag Order producer. Each step is assisted by computer applications software programs and interactive displays. The Fragger follows "cook book" procedures for mundane operations, selecting information from various data banks and entering it into the display. For rote operations, computer programs may index through data banks to supply the needed entries. Fragger expertise is exercised in selection of support data, adjustment of results for real world complexity and introduction of new or unquantified data. At appropriate points the computer executes an applications programs which moves the process to the next step. The definable steps for purpose of this paper are:

Step One	Air Battle Objectives Development
Step Two	Strategy Projection/Strike Generation Matrix Development
Step Three	Apportionment and Allocation Briefing
Step Four	Strike Generation Proposal (Frag Shell Development)
Step Five	Authorization
Step Six	Dissemination

Step One, Air Battle Objectives Development

After reviewing the current situation from the various sources available to him, the Air Battle Commander (ABC) and/or his Deputy for Combat Operations (DCO) convenes the Tactical Exploitation Team. The commander/deputy and his exploitation staff review data on results of the battle to date and status of

forces available for the air war. They then discuss and articulate objectives of tomorrow's effort. Assistance is provided by computer generated graphics projected on the conference room viewing screen. They then set themselves to applying friendly forces to accomplish the objectives. Two data bases must be merged to produce a true picture of how many sorties of each kind are available to be Fragged. These two data bases are (a) the projected status of forces and (b) initial estimated apportionment and allocation. (The program can start with yesterday's apportionment/allocation figures or new estimated figures).

Projected Status of Forces

WOCS are responsible to report numbers of mission ready aircraft and aircrews. The Director of Combat Operations mandates the sortie rate for each aircraft type. WOCS also report specialized weapons sorties available. WOC data is reported and entered at regular intervals or as changes occur. Factors which affect this data are: combat losses, maintenance capability, turnaround capability, augmentation status, etc.

Apportionment, Allocation and Distribution

The employment of air forces as part of the air/ground/naval/joint/ combined operation is the responsibility of the CACC as approved by the CINC. Each day the CACC staff assesses the results of the battle and recommends apportionment of air assets to support overall battle strategy for tomorrow. These apportionment and allocation categories are:

Apportionment (CINC)	Allocation (CACC)
* Counter Air	* Defensive Counter Air (DCA)
	* Offensive Counter Air (OCA)
* Offensive Air Support (OAS)	* Close Air Support (CAS)
	* Battlefield Air Interdiction (BAI)
* Interdiction (INT)	* Interdiction (INT)

The Ground Component Commander distributes OASCAS among the various field commands. The Naval Component Commander (if supported by Air Force assets) does likewise for his surface units. This distribution reflects priority target servicing requirements as expressed in current OPLANS and OPORDS. Requests for preplanned air support are honored according to this distribution.

Sorties Available Computation

This algorythm produces a figure for sorties available by type of mission:

A. Air to Air (A/A)
   1. DCAINT
   2. OCACAP
B. Air to Ground (A/G)
   1. OASBAI
   2. OASCAS
   3. OCASTK
   4. OCAWW
   5. INTSTK

Parameters considered (from WOC/RMC data banks) are:

A. Unit Designation (Wing/Squadron)
B. Number of Aircraft O/R
C. Dedicated Aircraft Applications (e.g., Wild Weasel)
D. Dedicated Unit Mission (A/A vs A/G)
E. Secondary Unit Mission/Limits (A/G vs A/A, Aircraft Conversion Kits on Hand, Crew Proficiency)
F. Special Unit Capability (e.g., Pave Tack, Maverick)
G. Unit/Base Sortie Generation Capability (i.e., Smooth Flow and Surge Sortie Rate, Quick Turn Capability)
H. Special Considerations (e.g., Unit Held in Reserve, Mission Changeover, Order of Priority for Mission Changeover)
I. Tasked Sortie Rate

Consider a sample data input:

Assume we are listing the 603rd TFS which is part of the 314th TFW. The entry for this unit would look like this:

A. 314 - 603 (unit designation)

B. 15 F-4E (aircraft O/R)

C. None (no specialized application)

D. A/A 15 (all interceptors)

E. A/G 7 (7 can be converted to A/G mission)

F. P/T 5 (5 can be converted to A/G and tasked for Pave Tack)

G. OSAN 20/40
603 6/12
(Physical turnaround/sortie generation limits at OSAN 20 MSN/hour smoothflow, 40 MSN/hour 3 day surge)
(603 Squadron is allocated 6 sorties/hour smoothflow, 12 MSN/hour surge as its share of capability among the several squadrons using OSAN facilities)

H. Priority 3 (Third in preference for conversion to the A/G mission. Two other squadrons will be converted to A/G before the 603rd)

I. 3.0 Surge (tasked sortie rates)
2.0 Smoothflow

This data is gathered and stored for each squadron. Each file is used throughout the computer assisted Frag Cycle to automatically task A/A sorties until max sortie rates are reached. The program may automatically draw down A/A sorties and task them for A/G sorties on a preset priority basis as attrition or changing strategy dictates. Built in warning flags are illuminated as limits are reached or special activities (such as A/C configuration change) are demanded.

The sample final computation for Step One is: Forces available at each unit times sortie rate summed over all assigned units. A sample result is:

UNIT	TASKING	PRIMARY MISSION
Wing A	400 Sorties	A/A
Wing B	300 Sorties	A/G
Wing C	300 Sorties	A/G
Wing D	100 Sorties	A/G
Wing E	200 Sorties	A/G
	300 Sorties	A/A
Wing F	400 Sorties	A/A
	100 Sorties	WW
	200 Sorties	A/A
	2300 Total Available	

Initial (or Going-in) Position on Apportionment/Allocation

The ABC/DCO based on air objectives discussions determines an initial estimated apportionment and allocation for a going-in position to Step Two. Unless a significant change of objectives has occurred, the current apportionment/allocation figures will be used. The purpose for this estimation is to give a going-in position to start the computer assisted Frag Generation, which in Step Two will result in the skeleton of the Frag forming our air attack in accordance with detailed considerations. During Step Two and at its conclusion the computer automatically tabulates sorties tasked by type and presents the actual apportionment/allocation figures resulting from application of objectives. The rationale for any difference between the initial and actual figures should be evident. Discussions during Steps One and Two will form a complete rationale for the final apportionment/allocation recommendation briefing. A sample going-in apportionment/allocation is:

C/A	50%		460 Sorties
	DCA	50%	230 Sorties
	OCA	50%	230 Sorties[5]
OAS	45%		414 Sorties
	CAS	40%	164 Sorties
	BAI	60%	250 Sorties
INT	5%		46 Sorties
TOTAL			920 Sorties

Step One is complete. Enter the data. An automatic program searches the missions available data file. If this apportionment cannot be met without reconfiguring aircraft, a warning message is shown.

Example:

Warning: Max Current A/G Tasking = 800
This Apportionment = 804
Instructions Please!

The necessary adjustment to initial apportionment can be made or A/A fighters must be reconfigured to A/G. It is not necessary to make the adjustment now, but this data must be kept in mind through performance of Step Two.

Step Two, Strategy Projection: The Strike Generation Matrix (SGM) Development

The objective of this step is to inject into air battle planning, the strategy guidance and objectives desired by the Air Battle Commander (ABC) or his Director of Combat Operations (DCO). There is a wide spectrum of possible applications for air forces due to their flexibility, mobility and degree of mass desired. Maximum tonnage of ordnance delivered is achieved by continuous turnaround of aircraft (smoothflow) at maximum rates allowed by facilities and human endurance. Maximum mass is achieved by large strike packages which make smoothflow impossible[6]. The formation of the strike generation matrix, with

participation of the ABC or DCO, provides the proper compromise which meets the desired air battle objectives. During the process of Step Two, deciding the desired number of strike sets and their composition to accomplish battle objectives, the ABC or DCO simultaneously forms the complete demonstration rationale for tomorrow's apportionment/allocation recommendations. Step Two is therefore closely interrelated with Step One.[4] Computer assistance enables a profound change from current, cut and try estimation methods for arriving at recommended apportionment, and becomes a strong argument for development of this computer assisted Frag Generation capability. During formation of the matrix, the ABC/DCO expresses his desires in terms of number of strike sets and their composition to meet objectives and strategy. Discussions on strategy and objectives are encouraged during the formation exercise with experts of the Tactical Exploitation Team. Targeteers and weaponeers, as well as Fraggers, benefit from these discussions which will facilitate rapid completion of Step Three. The software program keeps track of forces available at predetermined generation rates and limits. When preset limits of force availability are not met, a warning flag illuminates with an explanation of force deficiency, force reconfiguration requirement or impractically of accomplishment.

Here is a proposed method by which this may be accomplished:

The Basic Strike Generation Matrix

The basic matrix is first programmed on a basis of 24 hour smoothflow. Parameters are agreed on for time allowable between aircraft takeoffs (turn time). Basic strike set force mix is based on employment doctrine, strategy and tactics. These parameters are entered by the Fragger into the baseline data bank as products of conferences, data from exercises and direction from the commander. The final video presentation of the smoothflow solution looks like this:

```
                          150                           150
                           I     140                     I
                   100     I      I     100              I     100
                    I      I      I      I      80       I      I
   40      40       I      I      I      I      I        I      I
   I       I        I      I      I      I      I        I      I      20
   I       I        I      I      I      I      I        I      I      I
TIME: 2    4        6      8      10     12     15       18     20     22
   A       B        C      D      E      F      G        H      I      J
```

FIGURE 4

The computer program has computed the sortie requirements for ten strike sets (A through J) according to parameters entered into data banks and searched out during execution of the program. In Figure 4, 920 sorties have been visually displayed in a map of the 24 hour air attack. This was accomplished by a program which considered and used, as necessary, the following parameters:

<u>One: Number of Strike Sets Desired</u>

This is a ABC/DCO or Fragger variable input. The number of strike sets should vary from day to day to keep the enemy off balance. They should also be adjustable to provide responsiveness to strategy changes. An advantage of this computer computation is that it can be run for any number of strike sets over a 24 hour period to give a quick look at effects of changing the number of strike sets. Limits of strike set generation capability will soon show up as the limiting cases when too many or too few strike sets are reached. The strategist can vary the number and size to suit the battle plan. The machine adjusts the force generation to keep our manipulations within workable bounds. Changes in force composition and generation capability, provided in a running tabulation by the computer, significantly aid the strategist in producing an optimum attack.

Two: Strike Set Composition Parameters (Examples)

A. Specialized tactics (e.g., certain types of air assets work in concert with supporting aircraft. In that case, the entire team must be fragged into the strike set.).

B. Some missions employ four-ship tactics.

C. All other flights are two-ship.

D. A desired basic mix of CAP to WW to strikers is entered into the program instructions.

E. Set size expands on a ratio of OCACAP to OCASTK or INTSTK flights.

F. A desired level of OASCAS is subtracted and assigned duty as CASFTR ground alert. Here the Fragger inputs desired levels of alert forces as dictated by air battle strategy. As requested, Army preplanned CAS arrives, sorties can be assigned to fill them from OASCAS in strike sets or from CASFTR set-asides.[7] For example, 50% of missions assigned OASCAS may be earmarked for CASFTR alert. Carrying this rationale further, if heavy ground fighting is expected 80-90% of OASCAS could be assigned to CASFTR with a corresponding drop in strike set assigned OASCAS. If light ground action is expected, more OASCAS can be assigned to strike sets. These missions will have secondary BAI missions. Thus, the waste of unused CASFTR alert aircraft can be minimized.

G. Time of day variable, e.g., heavy at dawn and dusk, lighter at other times, lightest during hours of darkness. Weather patterns may also be a factor here.

H. Strike set window parameters: Strike set tacticians and players would reach agreement through conferences, meetings, etc., on what time frame and geographic area of coverage should be planned for a strike set of

particular size and composition. All strike aircraft would them operate under the effective CAP/WW umbrella. Sufficient time will be allowed for strikers to get in and get out without conflicting with each other, but within the shortest allowable time frame to preserve mass and improve mutual support and survivability. OCACAP and WW planners consider how large a chunk of sky they can reasonably achieve temporary air superiority over and influence strike set size, composition and targeting.

I. Random time generator to randomly vary spacing of strike sets. This avoids the "regular as clockwork" syndrome which allows enemy gunners to take "regular as clockwork" naps.

J. Other parameters can be developed and implemented as experience with the program increases.

Individual Strike Set Edit Feature

Figure 4 presented a graphic depiction of the entire day's strike sets. The individual strike set edit feature allows us to zero in on any one strike set to critically examine the computed composition. It could look like this:

Strike Set Time for 0600

Total Sorties Generated = 100

INDEX	MSN	MIN REQUIRED	SORTIES GENERATED
1	OCACAP	30	30
2	OCASTK	15	15
3	OASBAI	30	30
4	INTSTK	15	15
5	OASCAS	6	6
6	W/W	4	4

Resources Remaining

MSN	TOTAL A/C	SORTIES REMAINING
A/A	25	81
A/G	27	117
W/W	10	20

FIGURE 5

The ABC/DCO and the Tactical Exploitation Team consider and adjust, as necessary, the composition of each strike set. At this time, objectives for each set are articulated. The force composition of the set is tailored to those objectives by adding/subtracting types of missions, adjusting set time and giving targeting guidelines. As each set is completed, the computer is instructed to fix the set numbers from further adjustment. The program then re-flows the remaining untasked forces over the remaining unfixed sets. Once all sets have been fixed, the computer tabulates the actual apportionment/allocation. The differences from the going-on position should be evident from the preceding discussion. If the required apportionment/allocation is unacceptable, the Step Two task can be reaccomplished, shifting mission assignments within certain sets to change sorties from one apportionment category to another. When agreement on apportionment is reached, Steps Three and Four can start simultaneously.

Step Three, Apportionment and Allocation Briefing

The Chief, Combat Plans Division emerges from the strategy projection meeting with the complete set of apportionment and allocation numbers, with rationale, required to achieve the detailed strategy worked out at the meeting. He then forms the apportionment/allocation briefing for presentation to the Air Component Commander (if he was not at the meeting) and the CINC. This briefing is forwarded via whatever channels are required, ideally via data link to the CINC/CACC command post computers. Given the computer link, well developed strategy and demonstrable objectives, approval will be obtained in a fraction of the current time required.

Step Four, The Strike Generation Proposal (SGP)

While the apportionment briefing goes forward for approval, the Frag continues to be generated. The next step is application of aircraft, targets and suitable weapons loads.

To start the process, the computer executes a program which searches the fighter wing record files and selects suitable aircraft by wing callsigns (not tailnumbers) and flows the available forces of all wings across the next day's strike generation matrix. The result is a frag shell which has the mission line completed and the remaining lines in blank format ready for fragger, targeteer, weaponeer input. Figure 6 is an example of a single entry in the computer generated frag shell.

```
MSN 5115     314 OSN  4 F-16     RAMROD 61    SET H  OASBAI F 18 JUL
ORD     SCL ____, ____, ____, ____
TOT 0600 , , ____  TGT ____________
TGT 2 ________________________________________
RMK ________________________________________
```

FIGURE 6

The display is called up by the tactical exploitation targeting cell. Based on discussions with the commander during formation of the strike generation matrix, this cell composed of a planner (fighter weapons employment expertise), a targeteer (intelligence information) with their combined (or additional, as required) weaponeering skills applies targets and weapons loads to the Frag. Here the previously determined strategy for tomorrow's strikes is executed. Considered are: weapons employment tactics, overall battle strategy, intelligence exploitation and weather probabilities.

A. The tactical exploitation targeting cell calls up each mission by set groups and enters primary, secondary targets and weapons loads. The targeting cell has available: displays of target lists, ground or air situation, air order of battle and the like.

B. Alternatively, a separate weaponeering cell could work with the tactical exploitation targeting cell on another console, applying appropriate SCL numbers. The weaponeering cell has displays of WOC or RMC data to assure sufficient stocks of the desired weapons are available.

If at any time the ABC or DCO determines the objective for one or more of tomorrow's strike sets must be changed, it is a simple matter to contact the targeting cell, jointly review the strike generation matrix and give the new objective direction. The required set is then recalled and retargeted.

The combat plans Fragger then reviews the strike set and enters TOT and routing instructions to assure deconfliction. Control frequencies and remarks are added as required.

Step Five, Authorization

The completed missions are collated by the computer and presented by strike set groups. The Fragger, targeteers, weaponeers and, if desired, the Air Battle Commander confer as each watches his video presentation, checking the Frag for accuracy and compliance with direction. Finally, a computer tabulation is performed in whatever format is desired by the Commander. An SGP review is presented along with a decision briefing to the Commander. Upon his approval, Step Six is initiated.

Step Six, Dissemination

This step is accommodated in the current Constant Watch and CAFMS concepts, either by autodin or data link. Each operational unit receives the Frag and prepares for its execution. It is conceivable that the time improvements allowed by the computer assisted system could permit incremental release of Frag Orders to allow the operational wings more lead time to prepare aircraft for assigned missions. This would also increase the commander's flexibility to adapt later portions of the Frag to changing battle requirements.

CHAPTER IV

ADVANTAGES

The capability represented by software applications depicted here offers some valuable, even revolutionary improvements to the system. The most obvious are:

Responsiveness

The Frag System will be more responsive to the commander's battle direction due to the following improvements:

Shortening the Decision-to-Execution Cycle for the Commander

Currently, the commander must decide his apportionment of forces some 30 hours before it will be in effect. He decides how to apportion his forces for the day after tomorrow, deciding on the basis of yesterday's results. This four day span is too long a decision time span to accommodate the modern high technology battlefield. Application of computer power offers hope of getting ahead of the enemy's strategy through efficient implementation of rapid counter strategy. Development of this computer assisted Frag Generation capability promises to cut Frag cycle time by two-thirds, giving commanders the capability to rapidly change entire air campaign strategy in a matter of hours, via the ATO.

Rapid Reaction to Changes in Strategy and Exploitation of Current Intelligence

Computer assisted Frag Generation can be stopped in mid-cycle and rapidly reracked to fit late breaking exploitation opportunities. Steps One through Four can be totally redone in minutes to produce a Frag which executes any

strategy desired. This is possible because the computer maintains the force status as a running tally during force planning manipulations to accomplish whatever task is desired. Automatic flags draw attention to force generation limits, permitting immediate restrategizing. The current hand cranked system is incapable of this responsiveness. Computer speed will permit incremental release of Frag Orders with benefits as stated above.

Visibility

Computer assistance permits electronic presentation to the commander at appropriate times, or as requested, to rule on differences of opinion or restate objectives. This is a quantum advance in visibility over the current single copy hand written Frag which the commander may never see before it is published. More importantly, it allows effective review and decision making on strategy and employment of forces by the commander.

Accuracy

By judicious selection of parameters, the computer can do automatic checking throughout the Frag Generation Cycle to warn the Fragger of approaching limitations and overextension of resources. It offers capability for accomplishment of last minute changes with a level of safety not possible in the present manual system.

Timely Force Apportionment/Allocation

The speed of the computer permits delay of the apportionment/allocation decisions until approximately noon of the day before, rather than the 30 hour lead time now required. In addition, formation of the Strike Generation Matrix in the morning strategy conference produces a fully supported set of apportionment/allocation numbers, a revolutionary improvement over the estimation process now in effect.

CHAPTER V

CLOSING STATEMENT

While all numbers used in this paper were fictional, they are representative of the real world, with the kinds of problems and considerations which at the present time can best be developed by the enhancement of the CAFMS and Constant Watch Programs. Whatever the result of this paper, and any similar efforts, there exists a critical need for a system of Frag Generation which permits the simultaneous production of a complex but well orchestrated Frag based on the commander's guidance and objectives. The products of electronic warfare technological advances now in development will enable the air battle commander to have exploitable information on the enemy critical to victory or defeat. This proposal gives him the tool to act on that information with decisive force while maintaining cognizance over management of his air campaign assets. This capability does not exist now nor is it planned within current force management system developments. The computer assisted ATO Generation System must thus be considered as an integral part of advanced surveillance and electronic warfare programs if they are to achieve their promise as an effective force multiplier.

The concept presented here introduces that capability. Our first efforts at demonstrating automated Frag Generation, with software written by Major Pete Crossman, my compatriot and friend in 603 TACC Combat Plans, has already shown the revolutionary possibilities for changing the way we plan and manage employment of tactical air forces. I have included some of our preliminary work as Appendix A.

Although this paper is not comprehensive in its address of the wide spectrum of Frags generated in the prosecution of war, it strikes at the major deficiencies in the current system. Given the computer assisted Frag

Generation capability described, all other foreseeable problems are solvable. My desire is that I have planted a seed and started the creative process necessary to development and incorporation of computer assisted Frag Generation capability into management of tactical air forces.

AUTHOR'S NOTES

1. The Air Tasking Order (ATO) originated as a breakout of the overall operations order, giving specific instructions to individual aircraft or multi-aircraft formations. Hence the nickname "Fragmentary Order" shortened simply to "Frag Order" or "The Frag" by busy aircrews. I was one of those crews and old habits die hard. In this paper I use the term "Frag" for ATO. It still sounds better. Of course, one who creates a Frag is a "Fragger".

2. The air war is conducted both defensively against the enemy ground and air offensive; and offensively, both to disrupt his second and third echelon forces and to interdict his capacity to wage war in the long term. Mission categories to accomplish these tasks are:

a. Defensive Forces
- Defensive Counter Air Alert Strip Interceptors (DCAINT)
- Close Air Support Alert Strip Fighters (CASFTR)

b. Offensive Forces
- Offensive Counter Air (OCA)
  - Combat Air Patrol (OCACAP)
  - Counter Air Strike (OCASTK)
  - Wild Weasel (OCAWW)
- Offensive Air Support (OAS)
  - Battlefield Air Interdiction (OASBAI)
  - Close Air Support Fighters (OASCAS)
- Interdiction Strike (INT)

3. The Tactical Exploitation Team concept is suggested by Colonel Chuck Link, 314 Air Division, Deputy for Combat Operations, as the logical means to capitalize on the advances in both Frag Cycle and improved real time

intelligence technology by bringing the full weight of combat planning expertise available in the TACC to bear on tomorrow's battle plan. This group, composed of action officers from Combat Operations, Combat Plans, Combat Intelligence, and supporting units as required, is the Air Battle Commander's means for (1) injecting commander's strategy and objectives into war planning and conduct, (2) reacting in real time to information and opportunities by which our forces can exploit enemy weakness or friendly forces successes. The group meets on demand and rapidly accomplishes tasks dealing with perishable opportunities for exploitation. In addition, scheduled meetings provide a forum for discussion of strategy, articulating the commander's guidance and objectives and forming the Strike Generation Matrix.

4. Step One and Step Two are closely interrelated. The Air Battle Commander may well use Step Two Strike Generation Matrix to form judgements and rationale for battle strategy and experimentation with apportionment/allocation numbers. The SGM formation exercise provides valuable insight into strategy effects on force management. An initial cut at program software has demonstrated the value of this Strike Generation Matrix exercise in forming apportionment/ allocation recommendations.

5. Offensive Counter Air is composed of both air to air (OCACAP) and air to ground (OCASTK, OCAWW) sorties. Further breakout program instructions for sorties in these categories are provided to the computer by agreement among weapons employment experts to achieve a proper ratio for any given enemy threat.

6. "Smoothflow" versus "Gorilla" strikes is an issue which has bedeviled air war planners and operators over the course of history. Each method, in its ultimate form, has objectives at opposite ends of the spectrum of tactical strategy. Simplistically stated, smoothflow provides the maximum sortie rates and tonnage of bombs with minimum forces. It produces maximum efficiency of effort, equipment, facilities and manpower. On the other hand, smoothflow reduces the number of forces in the air at any given time. The gorilla strike

strategy gathers large proportions of the available forces into the air at one time. This promotes mass firepower concentration but severely degrades the efficiency of the ground support operation which has to deal with large cumbersome batches of aircraft, storing up resources to build the gorilla and getting left with a large batch of expended and broken airplanes when the gorilla returns to base. At its best, the gorilla strike kills a difficult target and displays our country's awesome air weapon at its toughest. In contrast to smoothflow, fewer targets have been hit, fewer sorties flown, less ordnance delivered and less total pressure put on the enemy's air and ground forces. There is an optimum point, between a single herculean gorilla strike and a one sortie per minute ultimate smoothflow, which best suits each battle strategy. The key is keeping track of the status of air assets - beancounting, if you will - which the computer does quite well. Human/computer formation of the Strike Generation Matrix has, as its objective, the identification of that optimum point to fit the desired strategy and objectives.

7. The strike sets offer a means to better use the OAS CASFTR ground alert assets when the ground battle does not demand CAS at as great a rate as estimated. CASFTR sorties can be assigned preplanned OASCAS orbits and TOTs coinciding with strike sets. If not used for CAS the fighters can join the strike set, going to an assigned alternate BAI target area. A sufficient CASFTR force is maintained for immediate CAS requests while otherwise idle assets are made available in a steady flow to the main battle area with alternate BAI missions if not used for CAS. A computer aided force management system will provide capability to Frag these missions on a real time basis.

GLOSSARY

1.	A/A	Air to Air Mission/Configuration
2.	ABC	Air Battle Commander
3.	A/G	Air to Ground Mission/Configuration
4.	ATO	Air Tasking Order
5.	BAI	Battlefield Air Interdiction/Allocation
6.	C/A	Counter Air Role (Apportionment)
7.	CACC	Commander, Air Component Command
8.	CAFMS	Computer Assisted Force Management System
9.	CAP	Combat Air Patrol (Air Cover)
10.	CAS	Close Air Support (Allocation)
11.	CASFTR	Close Air Support, Ground Alert Fighter
12.	CCTV	Closed Circuit Television
13.	CINC	Commander-in-Chief, Joint/Combined Forces
14.	CRT	Cathode Ray Tube (Video Graphic Display)
15.	DCA	Defensive Counter Air (Allocation)
16.	DCAINT	Defensive Counter Air Intercept Mission
17.	DCO	Director of Air Combat Operations
18.	Frag	Fragmentary Order, the ATO
19.	Fragger	One who produces a Frag
20.	INT	Interdiction Role (Apportionment)
21.	INTSTK	Interdiction Strike Mission
22.	MSN	Mission
23.	OAS	Offensive Air Support Role (Apportionment)
24.	OASCAS	OAS Close Air Support Preplanned Mission
25.	OCA	Offensive Counterair (Allocation)
26.	OCACAP	OCA Combat Air Patrol Mission
27.	OCASTK	OCA Air to Ground Mission
28.	OCAWW	OCA Wild Weasel Mission
29.	O/R	Operationally Ready (for Combat)
30.	POL	Petroleum, Oil, Lubricants

31.	RMC	Resources Management Center
32.	SCL	Standard Conventional Load
33.	SGM	Strike Generation Matrix
34.	SGP	Strike Generation Proposal
35.	Striker	Air to Ground Attack Aircraft
36.	TACC	Tactical Air Control Center
37.	TACS	Tactical Air Control System
38.	TAFIG	Tactical Air Forces Integration Group (HQ TAC)
39.	WOC	Wing Operations Center
40.	WWMCCS	World Wide Military Command and Control System

INTRODUCTION TO ANNEX A

In July 1981 a prototype of a Frag Generation System was built by Major Pete Crossman, 314AD/Combat Plans, using the "basic" language on the Honeywell H6000 Computer System. This program allowed the testing of Major Sowa's ideas and the resulting algorythms for practicality and workability. The prototype was extremely successful. It provided an insight into what was and was not needed for an automated Frag Generation System. The samples which follow were generated using that prototype. It is hoped that the time and effort expended on this project will eventually lead to a more sophisticated programming effort which will ultimately automate the "front end" of the present Fragging System. What follows is a demonstration of the capabilities of this "Fragen" System.

The figures presented on the following pages are faithful copies of actual computer video displays. Subtitles and plain language explanations are added to guide the reader.

```
UNITREP FILE MAINTENANCE

(I) - INITIALIZE 'UNITREP' FILE
(A) - ADD NEW ENTRIES
(D) - DELETE OLD ENTRIES
(M) - MODIFY EXISTING ENTRIES
(L) - LIST ALL ENTRIES
(R) - REPORT GENERATOR
(C) - CALLSIGNS
(X) - EXIT THIS MODULE

ENTER COMMAND?
```

FIGURE A-1.1 SAMPLE COMPUTER INSTRUCTION MENU

Throughout the program self explanitory program instruction menus guide the operator.

UNIT	BASE	TYPE A/C	NO. A/C	SORTY RATE	TURN TIME	MISSION TYP	PRI	EXP	SPC	SHIP	SVC	INDEX
3	KUZ	F-4G/E	24	2.5	3.0	W/W	XXX	XXX	XXX	2	F	1
8	KUZ	F-4D	18	2.4	3.0	A/G	XXX	XXX	XXX	2	F	2
10	SWN	F-5	10	3.0	3.0	A/G	XXX	XXX	XXX	2	R	3
10	SWN	F-5	14	3.0	3.0	A/A	XXX	XXX	XXX	2	R	4
11	TAG	F-4D	54	2.4	3.0	A/G	XXX	XXX	XXX	2	R	5
15	SOL	F-86	14	3.0	3.0	A/G	FTR	XXX	XXX	2	R	6
15	SOL	F-86	22	3.0	3.0	A/A	INT	CAP	XXX	2	R	7
16	YCN	F-5	14	3.0	3.0	A/A	XXX	XXX	XXX	2	R	8
16	YCN	F-5	10	3.0	3.0	A/G	XXX	XXX	XXX	2	R	9
17	CHJ	F-4E	34	2.4	3.0	A/A	XXX	XXX	XXX	2	R	10
18	KWJ	F-15	24	2.0	3.0	A/A	XXX	XXX	XXX	4	F	11
51	SWN	A-10	18	3.0	3.0	A/G	BAI	STK	XXX	2	F	12
51	OSN	F-4E	14	2.4	3.0	A/A	XXX	XXX	XXX	2	F	13

FIGURE A-1.2 SQUADRON INFORMATION FILE
(ALL NUMBERS ARE FICTICIOUS, FOR DEMONSTRATION PURPOSES ONLY)

A. This display:

1. Is maintained by WOCS and/or RMC.
2. Gives instructions on aircraft peculiar sortie capability, tasking and utilization.

B. Notes:

1. No. A/C: Actual number expected to be O/R for tomorrow's battle.
2. Sorty Rate: Expected average sorties per aircraft O/R per day.
3. Turn Time: Minimum time allowed between takeoffs for any one aircraft.
4. Mission Type: Denotes current configuration of aircraft by major type, i.e., A/A, A/G, or specialized configuration such as W/W.
5. Primary Mission: Indicates first preference mission for frag purposes by virtue of best capability, aircrew training, unit assignment, etc.
6. Mission Exemption: Denotes frag missions the particular aircraft cannot do.
7. SPC: Reserved for later use.
8. Ship: Denotes employment of aircraft in pairs, 4-ship or singly.
9. SVC: Service of aircraft (F - USAF, R - ROKAF, etc.)
10. Index: Machine function number.

APPORTIONMENT FIGURES

MAXIMUM SORTIES AVAILABLE IS 680
TOTAL SORTIES AVAILABLE: A/A = 312 A/G = 328 W/W = 60

MSN	%	SORTIES
OAS	20 %	136
C/A	60 %	408
INT	20 %	136
TOTAL	100 %	680

FIGURE A-2.1 INITIAL APPORTIONMENT ESTIMATE

ALLOCATION FIGURES

TOTAL SORTIES AVAILABLE: A/A = 312 A/G = 328 W/W = 60
SORTIES AVAILABLE FOR OAS = 136

MSN	%	SORTIES
OASCAS	30 %	40
OASBAI	70 %	95
TOTAL	100 %	135

FIGURE A-2.2 INITIAL OAS ALLOCATION ESTIMATE

ALLOCATION FIGURES

TOTAL SORTIES AVAILABLE: A/A = 312 A/G = 328 W/W = 60
SORTIES AVAILABLE FOR C/A = 408

MSN	%	SORTIES
DCA	50 %	204
OCA	50 %	204
TOTAL	100 %	408

FIGURE A-2.3 INITIAL COUNTER AIR ALLOCATION ESTIMATE

The initial apportionment and allocation percentages are input by the Deputy for Combat Operations as an outcome of air battle objectives discussions during Step One of the Frag Generation Cycle. The computer merges the percentages with the unit information file to provide the corresponding sortie numbers.

MSN	SORTIES AVAILABLE	SORTIES REQUIRED
A/A	312	293
A/G	328	326
W/W	60	60

DO YOU WANT TO:

(Y) - RECONFIGURE AIRCRAFT
(N) - DO NOT RECONFIGURE AIRCRAFT
(R) - RECOMPUTE APPORTIONMENT
(M) - RETURN TO MENU

ENTER COMMAND? N

FIGURE A-3 APPORTIONMENT/ALLOCATION CROSSCHECK FUNCTION

Enables the planners to compare the apportionment and allocation figures to the existing force configuration.

```
WOULD YOU LIKE TO:
                    (O) - USE OLD STRATEGY
                    (M) - MAXIMIZE THE NUMBER OF STRIKE SETS
                    (S) - SPECIFY THE NUMBER OF STRIKE SETS
                    (B) - BUILD YOUR OWN STRATEGY
                    (R) - RETURN TO MENU
ENTER COMMAND? M
```

FIGURE A-4.1 COMPUTER INSTRUCTION MENU

The program offers the following choices to start the air battle planning:

CHOICE	EXPLANATION
O	REPEATS THE LAST SGM
M	SMOOTHFLOWS THE EXISTING FORCES OVER THE MAXIMUM NUMBER OF STRIKE SETS.
S	ALLOWS THE PLANNER TO SPECIFY HOW MANY STRIKE SETS DESIRED.
B	PRESENTS A CLEAN SLATE ALLOWING THE PLANNER COMPLETELY FREE PLAY IN BUILDING TOMORROW'S SGM.

ENTER COMMAND? M

The planner has chosen to allow the program to build the SGM for maximum number of strike sets.

STRIKE GENERATION MATRIX

```
                                                            54
                                                             I
                                                             I
                   48                                        I
              42   I    42                             42    I
               I    I     I                              I   I    36
               I    I     I     30    30  30     30      I   I     I
               I    I     I      I     I   I      I      I   I     I
               I    I     I      I     I   I      I      I   I     I
       16      I    I     I      I     I   I      I      I   I     I   14
10      I      I    I     I      I     I   I      I      I   I     I    I    6
------------------------------------------------------------------------------
     2      4       6     8     10    12     14      16     18    20   22   24
 .      .      .    .     .      .     .   .      .      .   .     .
                                                                        *    *

MAXIMUM SORTIES AVAILABLE =  456 TOTAL SORTIES GENERATED =  430 / 0
EXIT(X) DISPLAY(D) EXPAND(E) HOLD(H) RELEASE(R) TIME(T):
ENTER COMMAND 'TIME,FUNCTION':? 22,E
```

FIGURE A-4.2 INITIAL STRIKE GENERATION MATRIX

The program has distributed the available forces across 14 strike sets in attempting to flow maximum strike sets, it has run short of assets late in the day. Warning flags (asterisks) draw attention to this fact. The next step is to examine these last two strike sets.

STRIKE SET 22 FOR TIME 2200   TOTAL SORTIES GENERATED = 14

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	2	2
OCASTK	2	2
OASBAI	4	4
INTSTK	4	* 2
OASCAS	0	0
W/W	4	4

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	37	24
A/G	78	0
W/W	16	8

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
2	2	4	4	0	4

FIGURE A-4.3 INDIVIDUAL STRIKE SET DISPLAY (STRIKE SET #22)

The warning flag was triggered by lack of minimum required INTSTK assets. If this is acceptable, the warning flag may be cleared by changing the required number of INTSTK sorties (4) to (2) on the requirements change menu at the bottom of the display. Note that the strike sets are labeled according to time in this demonstration. Strike set #22 indicates the strike set on or near 2200 hours, it is not the 22nd strike set.

STRIKE SET 24 FOR TIME 2400   TOTAL SORTIES GENERATED = 6

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	2	2
OCASTK	0	0
OASBAI	2	* 0
INTSTK	2	* 0
OASCAS	0	0
W/W	4	4

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	43	22
A/G	102	0
W/W	16	4

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W	
..	..	..	..	..	..	0
2	0	2	2	0	4	

FIGURE A-4.4 INDIVIDUAL STRIKE SET DISPLAY (STRIKE SET #24)

The last strike set of the day ran out of A/G sorties. In this initial SGM, since we will be examining each strike set in detail, it is only important to note how many sorties remain untasked by the automatic program. Twenty-two sorties A/A and four sorties W/W are available for addition to the SGM during the following SGM fine tuning exercise. We are also warned that A/G sorties are our critical resource. There is no need to clear warning flags at this preliminary stage.

```
                     STRIKE GENERATION MATRIX

                                                            84
                                                            I
                                                            I
                                                            I
                                                            I
              42  50     42  50                         42  I
      34      I   I      I   I           36             I   I
       I      I   I      I   I       30   I     30      I   I
       I      I   I      I   I        I   I      I      I   I
       I      I   I      I   I        I   I      I      I   I
----------------------------------------------------------------------------
   2       4      6      8     10    12     14     16      18   20   22   24
       .      .   .      .   .        .   .      .      .   .

MAXIMUM SORTIES AVAILABLE =  456 TOTAL SORTIES GENERATED =  440 /
EXIT(X) DISPLAY(D) EXPAND(E) HOLD(H) RELEASE(R) TIME(T):
ENTER COMMAND 'TIME,FUNCTION':?
```

FIGURE A-5.1 FINAL STRIKE GENERATION MATRIX

Starting with the initial smoothflow SGM (Figure A-4.2) and the critical resources information from examination of the last strike sets (Figures A-4.3, 4.4), the Tactical Exploitation Team critically examines each strike set, one by one, to form them for application to specific objectives. This final matrix is considerably different from the going-in SGM in Figure A-4.2. The rationale for the difference has been recorded during the strategy projection discussions by the Chief, Combat Plans Division and becomes background information for his preparation of the apportionment/allocation briefings. To get from initial to final SGM the Tactical Exploitation Team applied objectives to the strike sets and tailored each set's assets to do the job. Specific actions are demonstrated in Figures A-5.2 through A-5.7.

STRIKE SET 5 FOR TIME 0500 TOTAL SORTIES GENERATED = 42

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	8	8
OCASTK	6	6
OASBAI	10	10
INTSTK	14	14
OASCAS	0	0
W/W	4	4

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	37	96
A/G	70	244
W/W	16	48

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
8	6	10	14	0	4

FIGURE A-5.2.1 STRIKE SET #5 (BEFORE)

STRIKE SET 5 FOR TIME 0530 TOTAL SORTIES GENERATED = 42

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	8	8
OCASTK	6	6
OASBAI	20	20
INTSTK	4	4
OASCAS	0	0
W/W	4	4

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	25	82
A/G	63	240
W/W	14	50

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
8	6	20	4	0	4

FIGURE A-5.2.2 STRIKE SET #5 (AFTER)

The team selects the first priority objective for tomorrow's war and tailors the nearest strike set to accomplish that objective. Here, assume intelligence information indicates major ground attacks at two points along the battle area. Our air battle strategy is to strike at dawn to disrupt second and third echelon forces. The first four daylight strikes are moved to 0530, 0600, 0800, 0830 and alternated between the two expected attack areas. The composition of this 0530 strike is shown before (Figure A-5.2.1) and after (Figure A-5.2.2) 10 INTSTK sorties have been redesignated to the OASBAI mission. This aligns the forces to attack second and third echelon targets. Note the computer calculates resources remaining as the program automatically reflows forces across the remaining sets. This restructuring is repeated for the four early light strike sets to accomplish objectives. The computer is then instructed to exempt these sets from further change, and we move to our next battle objective.

STRIKE SET 18 FOR TIME 1800 TOTAL SORTIES GENERATED = 54

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	12	12
OCASTK	8	8
OASBAI	12	12
INTSTK	18	18
OASCAS	0	0
W/W	4	4

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	27	34
A/G	42	32
W/W	16	16

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
12	8	12	18	0	4

FIGURE A-5.3.1 STRIKE SET #18 (BEFORE)

STRIKE SET 18 FOR TIME 1830 TOTAL SORTIES GENERATED = 84

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	24	24
OCASTK	12	12
OASBAI	0	0
INTSTK	40	40
OASCAS	0	0
W/W	8	8

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	15	0
A/G	28	4
W/W	12	12

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
24	12	0	40	0	8

FIGURE A-5.3.2 STRIKE SET #18 (AFTER)

Operations and intelligence planners have been alerted to a lucrative target array deep in enemy territory. Current intelligence indicates that tomorrow evening is the optimum time to strike. Set #18 is designated to accomplish this objective.

The OASBAI mission is inappropriate to the deep interdiction objective. Therefore, the 12 OASBAI sorties are redesignated as INTSTK. The targets area is a known heavy defended area. Therefore, the OCACAP, OCASTK and W/W assets are beefed up to counter the enemy air order of battle. Note the resources remaining table indicates we have tasked our A/A assets to the maximum at this point. Fifteen aircraft are regenerated from previous sorties but the unit tasked sortie rate has been met. This fact causes the group to consider the fact that no more OCACAP is available for subsequent sets without reallocating DCA sorties to OCA or reassigning other remaining assets to the OCACAP mission. For this day, the DCO has accepted the maximum extension of existing OCACAP assets and cancels the last two programmed strike sets.

STRIKE SET 3 FOR TIME 0330 TOTAL SORTIES GENERATED = 34

MSN	MIN REQUIRED	TOTAL GENERATED
OCACAP	20	20
OCASTK	6	6
OASBAI	0	0
INTSTK	0	0
OASCAS	0	0
W/W	8	8

RESOURCES REMAINING:

MSN	A/C	SORTIES
A/A	35	96
A/G	94	272
W/W	18	54

OCACAP	OCASTK	OASBAI	INTSTK	OASCAS	W/W
..	..	..	..	..	..
20	6	0	0	0	8

FIGURE A-5.4 STRIKE SET #3 (AFTER)
(COMBINING INITIAL SGM STRIKE SETS 0100 AND 0300)

As discussion terminates on strike set #18, an operations alert warning flashes on the conference room display. The Senior Duty Officer (SODO) appears via CCTV and briefs that B-52s have been released to support the air battle. They can be over the battle area at 0330 tomorrow. The DCO accepts the TOT, instructing the SODO to reply in the affirmative and instructs that our escort package will be ready and in the Frag this afternoon along with a suitable target. Discussion turns to targeting objectives and building a suitable escort package. Strike sets 0100 and 0300 are combined into strike set #3 and augmented as desired to form an appropriate package for suppression of air defenses to create a permissive environment for the B-52 attack on enemy troops and armor concentrations.

The computer reflows forces over non-fixed strike sets. A quick review of these remaining strike sets finalizes the SGM (Figure A-5.1).

APPORTIONMENT/ALLOCATION FIGURES

MAXIMUM SORTIES AVAILABLE - 700

TARGET - 680 GENERATED - 684

MISSION	%	SORTIES	%	SORTIES
OAS	20 %	136	22 %	150
OASCAS	30 %	40	27 %	40
OASBAI	70 %	96	73 %	110
C/A	60 %	408	61 %	416
DCA	50 %	204	49 %	204
OCA	50 %	204	51 %	212
OCACAP	44 %	89	51 %	108
OCASTK	26 %	54	26 %	56
W/W	29 %	59	23 %	48
INT	20 %	136	17 %	118
INTSTK	100 %	136	100 %	118

TOTAL AIRCRAFT AVAILABLE: A/A = 122 A/G = 124 W/W = 24
TOTAL SORTIES AVAILABLE: A/A = 312 A/G = 328 W/W = 60

FIGURE A-6

The computer then presents the apportionment and allocation figures both initial estimates (target) and actual from the finished SGM (generated). In our example, we see the following changes have been induced:

	APPORTIONMENT	ALLOCATION
OAS	+2 %	
OASCAS		-3 %
OASBAI		+3 %
C/A	+1 %	
DCA		-1 %
OCA		+1 %

In addition, our original program smoothflow instructions on proportions of OCACAP to OCASTK and W/W have changed slightly. This becomes good data for our next SGM exercise and provides information on our tactical forces mix.

The above apportionment/allocation figures along with rational from the Tactical Exploitation Team discussions are formed into decision briefings for the CINC and CACC. Meanwhile, Frag Generation continues in the Combat Plans Division.

FLOW ALLOCATION

UNITBASE	A/C	SORTY RATE	TURN RATE	SVC ID	SORTY AVAIL	OCA CAP	OCA STK	OAS BAI	INT STK	OAS CAS	W/W	CAS FTR	DCA INT	TOT SRT
KUZ F-4G	W/W 24	2.5	3.0	F	60	0	0	0	0	0	48	0	0	48
KUZ F-4D	A/G 18	2.4	3.0	F	44	0	18	6	20	0	0	0	0	44
KWJ F-15	A/A 24	2.0	3.0	F	48	48	0	0	0	0	0	0	0	48
SWN A-10	A/G 18	3.0	3.0	F	54	0	0	54	0	0	0	0	0	54
OSN F-4E	A/A 14	2.4	3.0	F	34	26	0	0	0	0	0	0	0	26
	SUB TOTALS:				240	74	18	60	20	0	48	0	0	220
SWN F-5	A/G 10	3.0	3.0	R	30	0	12	4	14	0	0	0	0	30
SWN F-5	A/A 14	3.0	3.0	R	42	0	0	0	0	0	0	0	42	42
TAG F-4D	A/G 54	2.4	3.0	R	130	0	20	38	50	0	0	0	0	108
SOL F-86	A/G 14	3.0	3.0	R	42	0	0	0	0	0	0	42	0	42
SOL F-86	A/A 22	3.0	3.0	R	66	0	0	0	0	0	0	0	66	66
YCN F-5	A/A 14	3.0	3.0	R	42	0	0	0	0	0	0	0	42	42
YCN F-5	A/G 10	3.0	3.0	R	30	0	6	8	16	0	0	0	0	30
CHJ F-4E	A/A 34	2.4	3.0	R	82	34	0	0	0	0	0	0	54	88
	SUB TOTALS:				464	34	38	50	80	0	0	42	204	448
	TOTALS:				704	108	56	110	100	0	48	42	204	668
	MIN REQUIRED:				0	108	56	110	118	0	48	40	204	

FIGURE A-7.1

This product displays the computer generated tasking which formed the SGM.

UNIT FLOW WORKSHEET

UNIT-BASE-A/C	0100	0200	0330	0400	0530	0600	0700	0800
3KUZ F-4G/E			.W/W 6		.W/W 4	.W/W 6		.W/W 4
8KUZ F-4D			.OCA 4		.OCA 2 .BAI 2 .INT 2	.OCA 2 .BAI 4 .INT 2		.OCA 2 .INT 6
10SWN F-5			.OCA 2		.OCA 2 .BAI 2 .INT 2	.OCA 2		.INT 2
10SWN F-5	.DCA42							
11TAG F-4D			.OCA 2		.OCA 2 .BAI 2	.OCA 2 .BAI14 .INT 2		.BAI 8 .INT 2
15SOL F-86	.FTR42							
15SOL F-86	.DCA66							
16YCN F-5	.DCA42							
16YCN F-5			.OCA 2		.BAI 2	.BAI 4 .INT 2		.INT 2
17CHJ F-4E	.DCA54		.CAP 4		.CAP 2	.CAP 4		.CAP 2
18KWJ F-15			.CAP 4		.CAP 4	.CAP 4		.CAP 4
51SWN A-10			.BAI 6		.BAI12			.BAI 6
51OSN F-4E			.CAP 4		.CAP 2	.CAP 2		.CAP 2

FIGURE A-7.2

This product provides sortie flow information corresponding to the SGM.

Figures A-7.1 and 7.2 provide the Fragger a crosscheck on computer generated unit tasking to assure feasibility. As experience provides confidence in the computer assisted Frag Generation System, these products could be released to WOCS to permit them longer lead time on airframe/aircrew planning and preparation for tomorrow.

Proceeding to Step Four in the computer assisted ATO Generation Cycle, the Fragger initiates the automatic Frag shell production program. The Frag shell, when completed with targets, weapons and all other necessary instructions, becomes the Strike Generation Proposal. To produce the Frag shell, the computer compares the flow sheet to the data files of available wing callsigns, mission numbers, and other necessary data. The result is a Frag shell with mission line complete, baseline TOT supplied and blank spaces to accommodate fill in of targets, weapons loads and all other necessary information. When complete, this becomes the SGP which is reviewed with the commander or director who authorizes its release.

```
MSN 2274     51 SWN    2 A-10      GUNNER    75    SET    E OASBAI F
ORD
TOT 0830
FAC
TGT
RMK
MSN 2300     51 SWN    2 A-10      GUNNER    81    SET    E OASBAI F
ORD
TOT 0830
FAC
TGT
RMK
MSN 2304     51 SWN    2 A-10      PETE      24    SET    E OASBAI F
ORD
TOT 0830
FAC
TGT
RMK
MSN 2310     51 SWN    2 A-10      PETE      05    SET    E OASBAI F
ORD
TOT 0830
FAC
TGT
RMK
MSN 2314     51 SWN    2 A-10      SWIFT     16    SET    E OASBAI F
ORD
TOT 0830
FAC
TGT
RMK
X**
MSN 4414      3 KUZ    2 F-4G/E    JOEJOE    26    SET    E OASWW  F
ORD
TOT 0830
RMK
MSN 4420      3 KUZ    2 F-4G/E    JOEJOE    57    SET    E OASWW  F
ORD
TOT 0830
RMK
MSN 4424      8 KUZ    2 F-4D      JUVAT     93    SET    E OCASTK F
ORD
TOT 0830
TGT
RMK
MSN 4430      8 KUZ    2 F-4D      DISCO     36    SET    E INTSTK F
ORD
TOT 0830
TGT
RMK
MSN 4434      8 KUZ    2 F-4D      DISCO     50    SET    E INTSTK F
ORD
TOT 0830
TGT
RMK
```

FIGURE A-8 COMPUTER GENERATED
STRIKE GENERATION PROPOSAL (FRAG SHELL)

```
MSN 4444     10 SWN    2 F-5      CIGAR     66    SET    E INTSTK R
ORD
TOT 0830
TGT
RMK
MSN 4450     11 TAG    2 F-4D     NOMAN     68    SET    E INTSTK R
ORD
TOT 0830
TGT
RMK
MSN 4454     11 TAG    2 F-4D     NOMAN     69    SET    E INTSTK R
ORD
TOT 0830
TGT
RMK
MSN 4460     16 YCN    2 F-5      COACH     02    SET    E INTSTK R
ORD
TOT 0830
TGT
RMK
MSN 4464     17 CHJ    2 F-4E     TOPCAT    59    SET    E OCACAP R
ORD
TOT 0830
RMK
MSN 4470     17 CHJ    2 F-4E     TOPCAT    16    SET    E OCACAP R
ORD
TOT 0830
RMK
MSN 4474     17 CHJ    2 F-4E     TOPCAT    41    SET    E OCACAP R
ORD
TOT 0830
RMK
MSN 4500     18 KWJ    4 F-15     HOOK      14    SET    E OCACAP F
ORD
TOT 0830
RMK
MSN 4506     18 KWJ    4 F-15     HOOK      44    SET    E OCACAP F
ORD
TOT 0830
RMK
MSN 4514     51 OSN    2 F-4E     DIZZY     85    SET    E OCACAP F
ORD
TOT 0830
RMK
MSN 4520     51 OSN    2 F-4E     DIZZY     53    SET    E OCACAP F
ORD
TOT 0830
RMK
MSN 4524     51 OSN    2 F-4E     DIZZY     38    SET    E OCACAP F
ORD
TOT 0830
RMK
```

FIGURE A-8 (CONT'D) COMPUTER GENERATED
STRIKE GENERATION PROPOSAL (FRAG SHELL)